

## Microcredit from Delayed Bill Payments

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# Motivation

- ▶ Households (HHs) have variable, uncertain incomes
- ▶ Smoothing consumption is costly
  - ▶ High interest rates from payday loans, credit cards, informal moneylenders, etc.
  - ▶ In Manila, only 4% have credit cards, 19% have bank accounts
- ▶ Public utilities (water, electricity, gas, etc.) may provide efficient, second-best credit by letting HHs delay their bill payments

# New policies reduce delinquency

- ▶ Growing use of prepaid meters that ensure upfront payments
  - ▶ benefits → may lower prices and increase investments in quality
  - ▶ costs → no more credit from delayed bill payments

Figure: Prepaid water meter in South Africa



- ▶ **Research Question** how much do HHs value delaying their bills?
  - ▶ How credit-constrained are HHs?
  - ▶ What are the welfare effects of other payment policies (ie. prepaid meters)?

# This Paper

- ▶ **Context** a regulated piped water utility in Manila
- ▶ **Data** monthly billing records from 2010-15 for 1.5 mil. connections
- ▶ **Approach** estimate a consumption/savings model where HHs choose when to pay their water bills
- ▶ **Results** monthly interest rate is 2.2% (30% annually) and willingness-to-pay for delaying bills is 70 PhP (or \$1.5) per month
  - ▶ Prepaid metering (adjusting prices to cover costs) reduces welfare

# Contributions to the Literature

- ① Bring consumption smoothing to public utility regulation  
(McRae [2015]; Szabó [2015]; Jack and Smith [2015,2016]; Szabó and Ujhelyi [2015])
- ② Estimate HH consumption/savings model with utility billing data  
(Deaton [1991]; Gourinchas and Parker [2002]; Laibson et al. [2007])
- ③ Measure credit constraints from billing delinquency  
(*RCTs*: Karlan and Zinman [2009]; Giné and Karlan [2014], *Village surveys*: Townsend [1994]; Townsend and Kinnan [2012]; Ligon [1994], *Natural Experiments*: Banerjee and Duflo [2012])

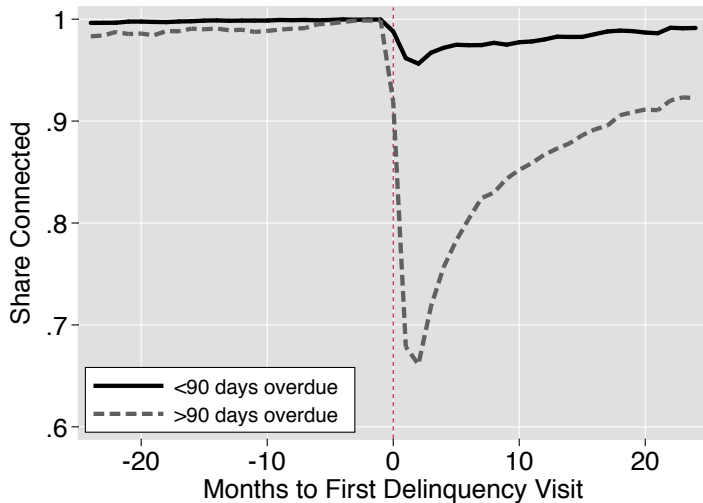
# Paying water bills in Manila

- ① The avg HH is 85 days behind on their payments
  - ▶ Avg HH's unpaid water bills = 5% monthly HH income
- ② No interest is charged on delinquent bills
- ③ The utility visits delinquent HHs and makes a take-it or leave-it offer: pay now or become disconnected
  - ▶ Visits are rare (4% of HH-months given >60 days delinquent)
- ④ To reconnect, HHs pay a small one-time fee and all unpaid bills
  - ▶ When HHs change residences, they rarely pay their outstanding bills

# Data and Sample

- ▶ Data
  - ▶ Monthly billing records per connection 2010-15 (usage, payments, and delinquency visits)
  - ▶ Merge to survey data on ~50,000 connections (number of HHs sharing a connection and demographics for the owner)
- ▶ Sample
  - ▶ Model single HH decisions
    - ▶ Keep residential connections that serve a single HH (67%)
  - ▶ Use delinquency visits for identification
    - ▶ Keep HHs with visits (31%)
  - ▶ Drop HHs that move
    - ▶ Drop if disconnected for the last 6 months of the sample (10%)

## Avg share connected around 1st delinquency visit





# Model of HH consumption and savings

$$\max E_t \left[ \sum_{\tau=t}^{\infty} (1 + \delta)^{t-\tau} u(w_{\tau}, x_{\tau}) \right]$$

$$\forall t \quad x_t + p(w_t)w_t = y_t + A_t - \frac{A_{t+1}}{1 + r_a} + S_t$$

- ▶ Utility,  $u(w_{\tau}, x_{\tau}) = \alpha \log(w_{\tau}) + (1 - \alpha) \log(x_{\tau})$  is over water,  $w_t$ , and all other goods,  $x_t$ , with discount rate,  $\delta$
- ▶ Budget constraint has water price,  $p(w_t)$ , and income,  $y_t$ , which takes values  $(1 + \theta)\bar{y}$  and  $(1 - \theta)\bar{y}$  with 0.5 probability
- ▶ HHs borrow and save with asset  $A_{t+1}$  where  $A_{t+1} \geq -\bar{A}$  and interest rate,  $r_a$ , is equal to  $r_h$  if borrowing ( $A_{t+1} \leq 0$ ) and  $r_l$  else
- ▶  $S_t$  allows for borrowing from water bills (cont.)

## Borrowing from water bills, $S_t$

- ▶ Each period, HH faces probability  $\pi$  of receiving a delinquency visit from the water utility
- ▶ If no visit occurs, HHs can borrow by not paying their bills

$$S_t = B_{t-1} - B_t$$
$$B_{t-1} - p(w_t)w_t \leq B_t \leq 0$$

- ▶  $B_{t-1}$  : last month's unpaid bill ( $\leq 0$ )
  - ▶  $B_t$  : this month's unpaid bill ( $= 0$  if  $A_t > 0$  to prevent arbitrage)
- ▶ If a visit occurs, HHs can choose to disconnect ( $D_t = 1$ ), avoid paying their bills ( $S_t = 0$ ), and pay a fixed cost ( $f$ ) per month for other water until they reconnect
- ▶ Otherwise, HHs pay off any unpaid bills ( $S_t = B_{t-1}$ ) and this month's bill ( $B_t = 0$ ) to stay connected

## Estimates with simulated method of moments

Calibrated			Source
Discount rate	$\delta$	0.015	Structural macro literature
Savings rate	$r_l$	0.003	World Bank
Visit risk	$\pi$	0.04	Billing data
Price	$p$	$20.2 + 0.2w$	Billing data
Mean inc. (PhP)	$\bar{y}$	31,910	HH inc. survey
Borrowing limit	$\bar{A}$	-32,250	HH inc. survey (95 pctl. of loans)
Unpaid bills limit	$\bar{B}$	-10,109	Billing data (95 pctl. of unpaid bills)

Estimated			Moments
Water preference	$\alpha$	0.024 (0.00075)	Avg usage
Income shock size	$\theta$	0.342 (0.0318)	Avg unpaid bills
Cost of other water	$f$	150.0 (34.3)	% Disc. 1-2 months post visit
Borrowing rate	$r_h$	0.022 (0.0055)	% Disc. 1-2 months post visit

# Counterfactuals

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	(1) Current	(2) No Water Borrowing
Compensating Variation (PhP)		-50.3
Mean Usage (m3)	26.64	25.05

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All values are at the household-month level.

## Counterfactuals

	(1) Current	(2) No Water Borrowing	(3) No Water Borrowing and Covering Costs
Compensating Variation (PhP)		-50.3	-51.1
Mean Usage (m3)	26.64	25.05	25.03
Price Intercept (PhP/m3)	17.16		17.19
Credit supply costs (PhP)	31.3		0
Marginal cost (PhP/m3)	5		5

All values are at the household-month level.

- Credit supply costs include (1) cost of delinquency visits, (2) lost revenue from HHs that move, and (3) opportunity cost of credit

## Counterfactuals

	(1) Current	(2) No Water Borrowing	(3) No Water Borrowing and Covering Costs	(4) Prepaid Metering and Covering Costs
Compensating Variation (PhP)		-50.3	-51.1	-225.2
Mean Usage (m3)	26.64	25.05	25.03	22.12
Price Intercept (PhP/m3)	17.16		17.19	22.86
Credit supply costs (PhP)	31.3		0	0
Marginal cost (PhP/m3)	5		5	5
Additional metering cost (PhP)	0		0	51

All values are at the household-month level.

Thank you!